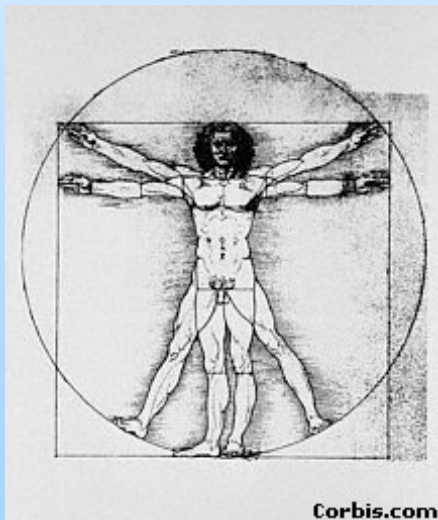# Modeling and Simulation in HSI
Current Capabilities and Future Needs

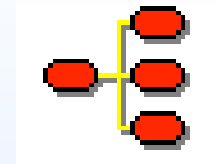## Human Systems Integration Symposium
Newport, RI
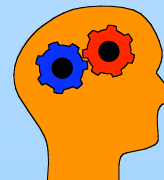## 3 May 2004

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Why and When M&S in HSI?

- Why?
  - We can't afford to get it wrong the first time
  - We need it for training
    - Not only shortens the pipeline, but adds an edge

- When?
  - Requirements generation and development
  - The entire *systems* engineering process
  - Training and life cycle management
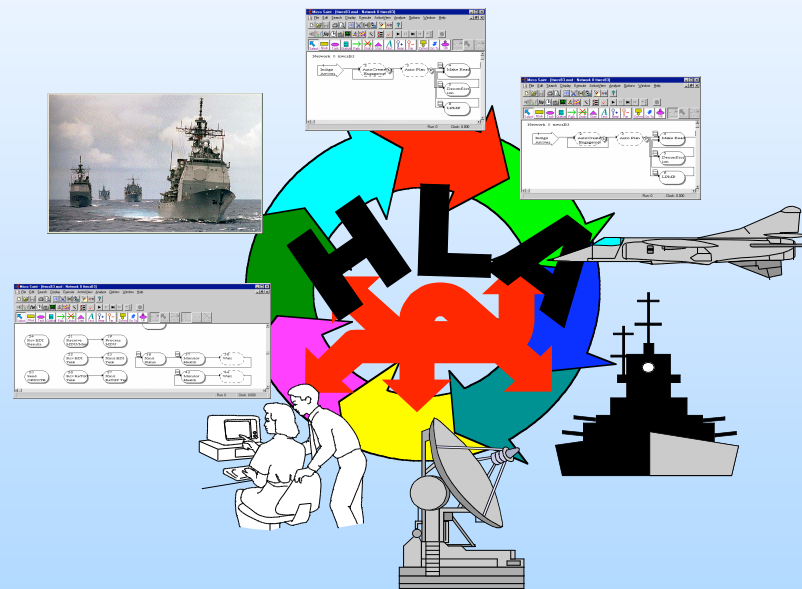
What we can do well today

- Manpower requirements determination and analysis
  - Support optimized manning
  - Includes consideration of technology, organizations, and processes in assessing relationship between manpower and performance

- Requirements determination
  - Human is another system component
  - Explicit consideration of expected human operating characteristics and how they interact
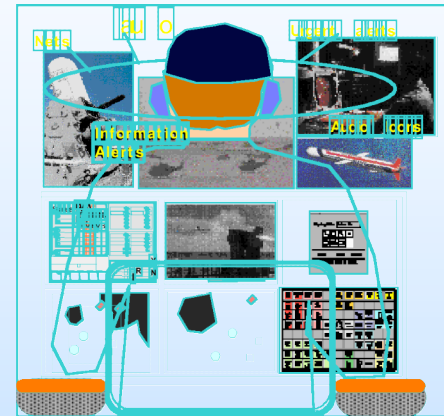
What we can do well today

- Play our human performance models with other system component models
 - Distributed simulation and simulation interoperability

What we can do *pretty* well today

- Predict human performance as a function of detailed user-interface design
  - Basic approach developed in the 1980s has evolved
  - Still not enough first principles of human performance for existing user interface technologies
  - Emerging user interface technology science base is weak
  - We are strong in the detailed user interaction modeling
    - but still relatively weak in user tactic and strategy selection
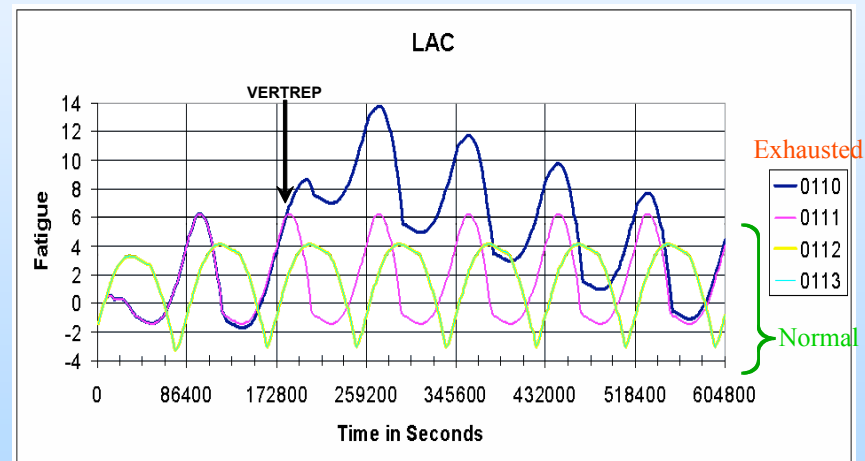
What we can do *pretty* well today
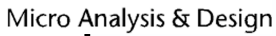
- Model basic command and control behavior

  - Command and control is a process performed by organizations using technology

  - Involves complex decision making and planning
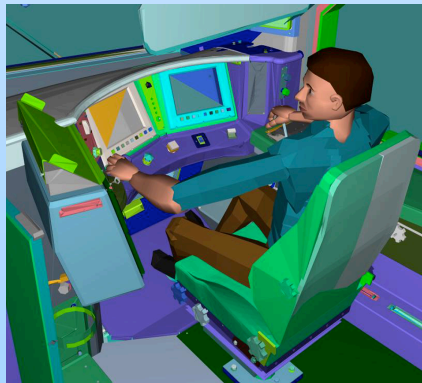
What we can do *pretty* well today

Micro Analysis & Design
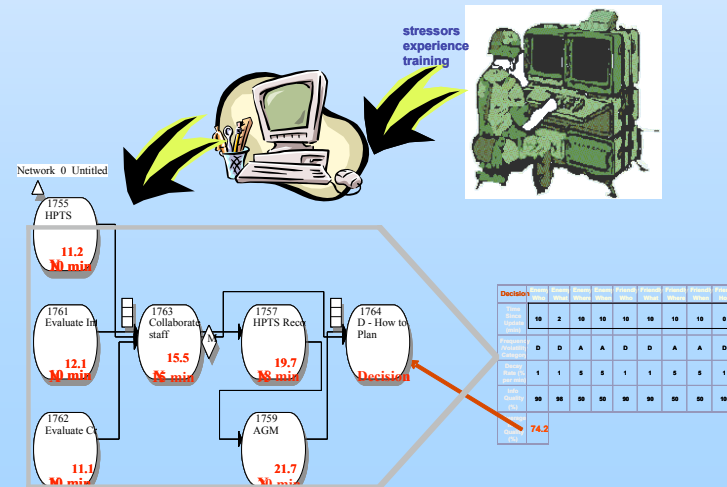
- Model human response to stressors and performance shaping factors
    - We're good at heat, fatigue, CBW, …
    - We're weak in motion/vibration, noise, leadership, training, motivation, …
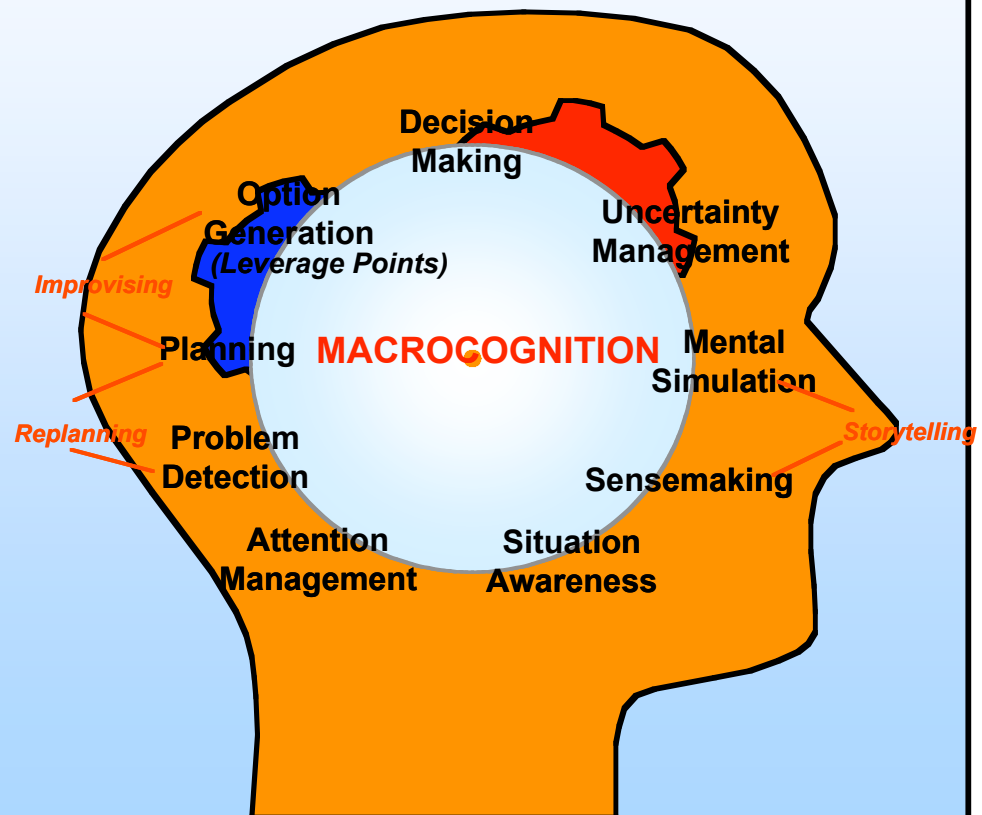
What we can do *pretty* well today

- Model human anthropometry and biomechanics
  - We have the data
  - We have the models
  - We have the tools
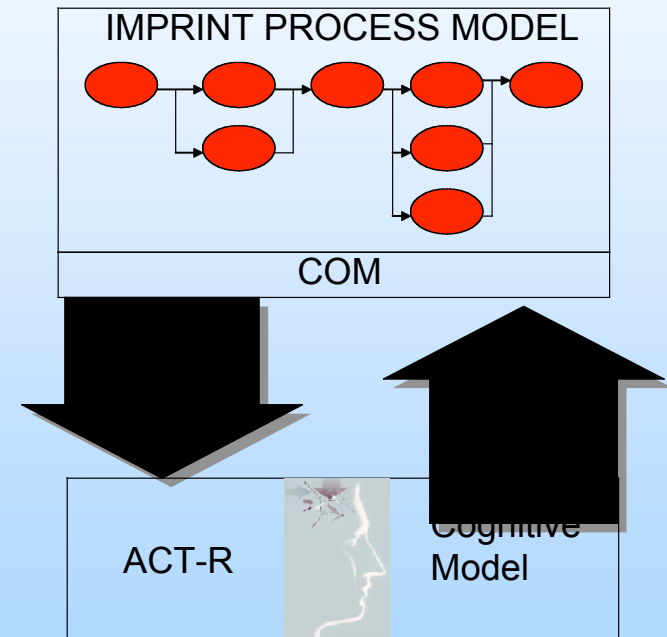
What we need to do better

- Better model and represent the elements that contribute to strategic and tactical planning and decision making behavior

What we need to do better

- ## Model human error
  - Tough to measure and validate since they don't occur frequently enough
    - HRA is a limited data set, but available
  - Must be based on root-causes of error
    - We know root causes qualitatively but not quantitatively

IMPRINT PROCESS MODEL

COM

ACT-R

Cognitive Model

What we need to do better

- Model how humans will deal with effects-based operations
  - The level of warfighter that must address EBO is constantly dropping
    - What does that mean to human performance?

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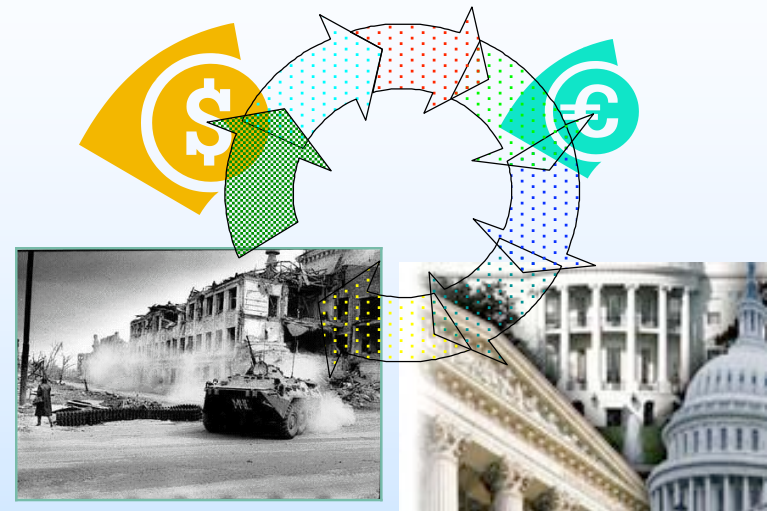
Things to remember when judging the state of human performance modeling

- Human performance models will never predict a simple value for any aspect of human performance
  - Human performance is never a value, it's always a range

- All models of systems that involve human performance include an embedded human performance model
  - Our job is to make the system models better by improving their representation of human behavior and variability